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**Bacillary White Diarrhoea or Fatal
Septicemia of Chicks**
AND
Coccidiosis or Coccidial Enteritis of Chicks

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INTRODUCTORY NOTE

Bacillary white diarrhoea or fatal septicemia, and coccidiosis, or coccidial enteritis, are the two most prevalent and most serious diseases of chicks. In California coccidiosis is very prevalent while outbreaks of bacillary white diarrhoea are comparatively infrequent. The name "white diarrhoea" has led to more or less confusion in the minds of many poultrymen regarding the exact nature of this disease. Since any disorder of very young chicks is liable to be manifested by a disturbance of the digestive system and consequent diarrhoea, with thin yellowish-white droppings which bring about a deposit of white material on the feathers below the vent, many outbreaks of so-called "white diarrhoea" are in reality due to errors in hatching or rearing and in no way related to the infectious disease, bacillary white diarrhoea.

By some writers, coccidia are given as one cause of "white diarrhoea" and, therefore, coccidiosis is classified as one form of white diarrhoea. Such a classification has caused considerable confusion in the minds of poultrymen and is, according to the observations made at this station, wholly unjustifiable. In none of the outbreaks of coccidiosis investigated by this station have there been any symptoms or history which might be confused with those of bacillary white diarrhoea. In the following pages the two diseases are taken up separately and an attempt made to describe them in such a manner as to avoid any confusion regarding their identity.

BACILLARY WHITE DIARRHOEA OR FATAL SEPTICEMIA OF CHICKS

Character of the Disease.—Bacillary white diarrhoea is an infectious disease of young chicks caused by an organism called *Bacterium pullorum*. The symptoms are usually a tendency to stay under the hover or stand in patches of sunlight, followed by droopiness and loss of appetite, and lastly diarrhoea, the droppings being usually light colored. Frequently the feathers below the vent become soiled with a chalk-like deposit which in long-standing cases may become as large as a walnut and block up the vent, a condition known to poultrymen as *pasting up behind*. The disease usually makes its appearance during the first week after the chicks are hatched, but the losses may continue for four weeks or more afterward.

Post-mortem Lesions.—The stomach, gizzard and intestines are usually pale and filled with a slimy fluid. The lower portion of the intestines is sometimes filled with feces due to the blocking up of the vent.

The liver is either a uniform dull ochre color or dull ochre streaked with bright red. This is one of the most prominent and constant lesions. The size is usually normal and very often the organ is quite soft. The gall bladder is normal in acute cases, but in cases of long standing it is distended with dark-colored bile.

The heart, spleen and kidneys are usually paler than normal, but this condition can be detected only by a practiced eye. The lungs are usually congested.

There is always an unabsorbed yolk in the abdominal cavity. This is the most characteristic lesion. The amount varies, according to the course of the disease, from a full-sized yolk to a piece no larger than a pin head. The consistency of the yolk also varies with the course of the disease; in the early stages it is large and watery, while in the cases of long standing it is smaller and gelatinous or cheesy in consistency. The color is usually yellow or yellowish brown.

Diagnosis.—Symptoms and lesions identical with those described can be produced by a variety of causes. They include improper incubation, overheating or chilling in the brooder or in shipment, feeding too soon after chicks are hatched, and improper feeding or over-feeding. Therefore, *pasting up behind* with chalky material, or the presence of lesions similar to the ones described, should not be considered as a positive indication that the chicks are infected with bacillary white diarrhoea. A *positive* diagnosis can be made only by a careful bacteriological examination of a dead chick.

Method of Infection.—The chicks which are infected with the bacillary white diarrhoea and do not die, continue to harbor the germs

throughout their lifetime. In hens such infection is localized in the ovaries, in males in the testicles.

Such fowls usually give no indication of the infection, are apparently in perfect health,¹ and very often are good layers. Post-mortem examination of such hens usually reveals ovarian lesions consisting of cysts and discolored yolks, although frequently a slight congestion of the ovaries is the only visible evidence of infection to be found. In males, the only lesion found is a congestion of the testicles and oftentimes this is absent. Pure cultures of *Bacterium pullorum* can be obtained from the ovaries or testicles of infected fowls. Some of the eggs laid by infected fowls contain these germs in the yolk; chicks hatched from such eggs are infected when born, and the infected chicks spread the contagion to the others. One such egg in an incubator would be sufficient to infect the entire hatch. Infected males eliminate the germs in the spermatie fluid and thereby infect hens during the process of breeding.² Chicks may also be infected by placing them in contaminated brooders. The most common source of infection, however, is hatching eggs laid by infected hens.

Course and Prognosis.—As a rule, this disease runs a very rapid course, death taking place within twenty-four to forty-eight hours or less after symptoms are noticed. Frequently, however, symptoms are present for as long as three weeks before death ensues. The percentage of mortality is usually high, the average being more than 50 per cent. Frequently as many as 90 per cent of the flock will die, but occasionally the loss will be slight.

Treatment.—Various methods of treating bacillary white diarrhoea have been recommended from time to time, but further investigation has in all cases shown them to be of little value. At the present time there is no satisfactory method of treating the sick chicks. Buttermilk or sour skim-milk seem to have a beneficial effect in some instances, but cannot be relied upon to check the disease when once it has started. However, this is just as satisfactory as any treatment yet suggested, and has the added advantage of being an excellent food for the chicks. Therefore preventive measures are more important than treatment for controlling this disease.

Preventing the Entrance of the Infection Through Infected Eggs.—Obviously, the certain way of preventing eggs from infected hens from getting in the incubator is to use hatching eggs from flocks

¹ One outbreak of a disease of mature fowls in which the percentage of mortality was high and the cause of which was *Bact. pullorum* has been reported. (Jones, F. S., Report of the N. Y. State Veterinary College, 1911-12.)

² Infected mature females can also transmit the infection to healthy mature females in the same flock.

known to be free from infection. If a poultry breeder has had no trouble with bacillary white diarrhoea in his own chicks or in chicks hatched by others from eggs produced by his flock, this may be taken as assurance that his flock is not infected. It is also possible to determine positively whether or not a flock is infected, either by bacteriological examination of the eggs, or by means of a blood test known as the "macroscopic agglutination test." The first method would necessitate that the hens be trap-nested and an examination made of each egg. Since an infected hen may lay no more than one infected egg a month, or even less, frequently the egg examination would have to be made daily for a long period and the amount of work required would make this method impracticable. The agglutination test has been proved to be reliable by numerous investigators.³ In Connecticut and Rhode Island upwards of twenty-five thousand fowls have been tested by this method. To make the test, a small amount of blood is drawn from the wing vein of each fowl. This is forwarded to a laboratory where the test is made. The results of investigations have shown that in order to pick out all the infected fowls two or more tests are necessary. Since it costs about ten cents per fowl to make the test, the necessity of making repeated tests would make this method too expensive for practical use. However, one test will show whether or not the flock is infected and herein lies its chief practical value. If a tested flock contained no reactors to one test, it could be considered as free from infection.

Preventing the Infection from Spreading to Healthy Chicks after it has Gained Entrance to the Flock.—To prevent the disease from spreading after it has gained entrance in a flock, all the sick chicks should be removed and destroyed, the house thoroughly cleaned and disinfected, thereafter cleaned daily, and the chicks divided into small flocks, the purpose of this being to prevent a large number of chicks from becoming infected in case all the infected chicks were not removed. An added advantage of having the chicks in small flocks is that any new cases that develop can be more easily detected.

Preventing Chicks Hatched from Non-infected Eggs from Becoming Infected.—The ways in which non-infected chicks could be infected after being put in the brooder house would be by placing them in a contaminated brooder or by the infection being carried in from infected flocks. Since the white diarrhoea germs are comparatively easy to kill, a *thorough* cleaning and disinfection of the brooder before the chicks are put in will destroy all infection; and, if care is taken to prevent the infection being carried in from diseased flocks by visitors, attendants, dogs, etc., there is little danger of the flock becoming infected.

Results of the Use of the Agglutination Test at this Station on a Small Number of Birds from Two Different Flocks.—Flock No. 1: In June, 1914, two dead chicks were brought to the Veterinary Science

³ Jones, Report of N. Y. State Vet. College, 1911-12, Journal of American Society of Instructors and Investigators in Poultry Husbandry, 1916; Gage, Mass. Agr. Exp. Station, Bul. 148, 1914; Rettger, Kirkpatrick and Jones, Storrs Agr. Exp. Station, Bul. 185, 1915; and others.

Laboratory for diagnosis. The owner reported that a majority of the chicks he had hatched that year had died when they were a few days old. A bacteriological examination of these chicks resulted in the isolation in pure culture from the heart blood and liver of *Bacterium pullorum* and, therefore, the disease was diagnosed as bacillary white diarrhoea. On inquiry it was learned that the chicks were hatched from eggs produced on the premises. Therefore, it seemed probable that the hens were the source of the infection and it was decided to attempt to pick out the mature fowls that were infected by means of the agglutination test. It was not possible to obtain permission of the owner to test more than four of the hens, and a small quantity of blood was drawn from the wing vein of each of the four fowls and the test made. Three of the hens reacted and one gave no reaction. Two of the reactors, and the non-reactor were procured from the owner and a post-mortem examination made. The ovaries of both of the reactors were found to be diseased and pure cultures of *Bacterium pullorum* were obtained. The ovaries of the non-reactor were normal.

Flock No. 2: In August, 1916, a poultry raiser reported a disease among his chicks which upon investigation proved to be bacillary white diarrhoea. Arrangements were then made to test some of the hens of the flock which produced the eggs from which the chicks were hatched. One hundred fowls were tested. About 65 per cent gave positive reaction. Several of the fowls were then killed and post-mortem examinations made. All the reactors killed had diseased ovaries while the ovaries of all of the non-reactors were perfectly normal. As far as could be determined by outward appearance, all the fowls tested were in perfect health.

Fifty more fowls from this same flock were tested in February, 1917, 50 per cent giving positive reactions. Post-mortem examinations were made of none of these fowls. All were apparently in perfect health.

COCCIDIOSIS IN CHICKS .

Coccidiosis or coccidial enteritis is an infectious disease of chicks caused by protozoon organisms known as coccidia (*Coccidium tenellum*). The intestines are usually the only organs infected, but occasionally lesions are found in the liver or lungs and other organs. Coccidia may exist in small numbers in the intestines of chicks without causing any apparent harm, but when they are present in sufficient numbers they destroy the mucous membrane lining of the intestines and death results. The caeca or "blind guts" are the portions of the intestines most seriously affected. The disease is seldom seen in chicks under two weeks or over four months of age.

The usual history of outbreaks of coccidiosis is that the chicks do well until they are a few weeks old, when they begin to look unthrifty, droop and gradually die. It is not at all uncommon for entire flocks of chicks to die in the course of a month or six weeks. The symptoms of the disease do not differ materially from those of some other diseases and are, therefore, merely suggestive of coccidiosis.

The feathers of sick chicks become ruffled and soiled; there is a marked paleness of the skin of the head and of the visible mucous membranes. The sick chicks are inclined to separate themselves from the rest of the flock and stand "humped up" with their eyes closed for hours at a time unless disturbed. Usually diarrhoea, which is sometimes bloody, is present. A bloody diarrhoea can be considered as positive evidence of coccidial infection. Chicks usually show symptoms for at least three or four days before death occurs.

The post-mortem lesions usually consist of an enlargement of the caeca. The contents of the enlarged caeca may be either normal in consistency and brown or reddish-brown in color, semiliquid and bloody, or solid and yellowish white, brown or red in color. Occasionally there is no enlargement of the caeca nor abnormal appearance of the contents, so the absence of enlarged caeca cannot be taken as an indication that the chicks are not infected with coccidiosis. Frequently there is an inflammation of the lining of the intestines throughout their entire length. All other organs are, in most cases, apparently normal. Symptoms and lesions very similar to these, however, may be produced by causes other than coccidiosis; therefore, a microscopical examination is necessary for a positive diagnosis. If coccidia are the cause they will be found in large numbers when the contents of the intestines are examined microscopically. Coccidiosis is spread by the organisms which pass out with the droppings of diseased birds. Other chicks become infected by drinking water or eating food, litter, or particles of soil contaminated by the droppings from diseased chicks. It has been demonstrated that these organisms will remain alive in soil for a year or more. Therefore, chicks that are allowed to run in yards in which infected chicks were kept the year previous are very likely to become infected.

There are no drugs which have been found to be practical for treating diseased chicks. Seemingly good results were obtained by emetine hydrochloride, but the cost of this drug prohibits its use. It is known, however, that the presence of acid and a perfectly healthy condition of the mucous membrane of the intestines inhibits the multiplication of these organisms and it is also known that unless they are present in large numbers very little damage is done. Therefore, the disease can be controlled if the mucous membrane is kept in a perfectly healthy condition and the intestinal contents acid. These conditions may be brought about by feeding the chicks sparingly of grain and mash (a superabundance of food in the intestines causes malfermentation which lowers the resistance of the tissues to the action of the organisms), and by feeding sour milk or buttermilk in large quantities, the lactic acid in the milk inhibiting the multiplication of the organisms. Good results can sometimes be obtained by giving hydrochloric acid in the drinking water, one teaspoonful of the acid per quart of water. If buttermilk or sour milk is unobtainable hydrochloric acid may therefore be used. Every effort to obtain sour milk should be made, however.

Investigation at this station has shown that the above measures can be put into successful practical application and that the follow-

ing sanitary measures and feeding method are an efficient means for controlling the disease:

Sanitary Measures.—If only a few chicks are visibly sick when the presence of the disease is discovered, remove them from the flock and either keep them isolated or kill and burn them, preferably the latter. If, however, a large percentage of the flock are visibly infected, remove only the worst cases, which should be killed and burned.

If possible, put the chicks on new ground. If this is not possible, plow or spade the yards. Thoroughly clean the houses with a strong hot disinfectant solution. After the floors have dried cover them with a thin layer of litter (shavings, chopped alfalfa hay or straw). Sweep out this litter *daily*, burn it and put fresh litter in the houses. The litter will collect the droppings, thus preventing them from sticking to the floor, and making the daily cleaning easy. Continue this daily cleaning until the chicks are old enough to roost, and for a longer period if all signs of the disease have not disappeared. If all signs of the disease have disappeared by the time the chicks are old enough to roost, deep litter can be put in the houses and the daily cleaning confined to the dropping boards underneath the roosts. It is advisable to exclude the chicks from the dropping boards by means of wire netting. Keep all feeding and drinking vessels scrupulously clean at all times.

Feeding Method.—Feed a *small* amount of grain night and morning. Feed mash during the middle of the day, never leaving it before the chicks longer than two hours.⁴ Feed greens as usual. Keep buttermilk in fountains constantly before the chicks. The restricted grain ration will keep the chicks hungry and they will consume large quantities of buttermilk. If too much grain and mash are fed and the chicks drink large quantities of buttermilk, sour crop is very liable to result. There is no danger of this occurring, however, if the amount of grain fed is small.

In most instances, if the above sanitary measures and feeding method are carefully followed, improvement in the condition of the flock will be noticeable in three or four days and all signs of the disease will have disappeared in from two to four weeks. The buttermilk will cause the droppings to be somewhat "watery," but this should not be considered as being at all dangerous.

The above feeding methods should be employed from the start, when chicks are put in houses and yards in which a flock infected with coccidia was kept the year before. Buttermilk has considerable food value, so that normal growth and development will be obtained.

Report of Three Outbreaks of Coccidiosis Successfully Controlled.—Three outbreaks of coccidiosis at this station have been successfully controlled by the employment of the above described sanitary precautions and feeding method. The first outbreak occurred in April, 1915, in a flock of 150 chicks, five and one-half weeks old. The presence of the disease was shown by some bloody droppings which upon micro-

⁴ In severe outbreaks withhold the mash entirely until the condition of the flock shows marked improvement.

scopical examination were found to contain large numbers of coccidia. The flock was then carefully examined and eight chicks picked out as visibly sick. They were at once isolated. A microscopic examination of the droppings of each of these eight chicks showed them to contain large numbers of coccidia. Although all the visibly sick chicks had been removed, bloody droppings containing large numbers of coccidia continued to appear on the dropping boards. This showed that although there were no visibly sick chicks in the flock there were some badly infected ones and that it was impossible to remove all the infected chicks by the isolation of all visibly sick.

The daily cleaning of the houses and "buttermilk diet" were then adopted. No more visibly sick chicks were noticed, and at the end of three weeks all evidence of the disease had disappeared. The chicks also showed normal growth, many of them weighing $1\frac{1}{2}$ pounds at nine weeks of age.

The second outbreak occurred in April, 1916, in a flock of 150 one-month-old chicks which were kept in the same yard as the flock just described. *More than half* of the chicks were *visibly sick* when the presence of the disease was discovered. The procedure for controlling the disease was the same as in the previous outbreak with the exception that *none* of the sick chicks was removed. A decided improvement in the condition of the flock was noticed within three days, and all evidence of the disease had disappeared a month later. Only one chick died from coccidiosis.

The third outbreak occurred in January, 1917, in a flock of 730 two-months-old chicks. About 60 per cent of the flock were visibly sick when the presence of the disease was discovered. Post-mortem examinations of several of the dead chicks showed the lesions in the caeca to be unusually severe. The control measures for this flock varied somewhat from those used in the previous outbreaks. The brooder house was immediately cleaned and disinfected and thereafter cleaned every other day instead of daily. A small quantity of grain was fed night and morning, but no mash was fed at any time. Buttermilk in fountains was kept constantly before the chicks. This much restricted grain ration kept the chicks very hungry and they consumed about forty gallons of buttermilk daily. Almost immediate improvement in the condition of the flock was noticed and in less than three weeks all evidence of the disease had disappeared. The entire loss by death was only thirty-five chicks. The above described control measures were carried out for three weeks when the chicks were placed in colony houses, mash again fed, and the amount of buttermilk given greatly reduced. All the chicks made normal growth.